

WHAT IS CLAIMED IS:

1. A magnetic memory comprising:
a sense amplifier; and
a calibration system configured to monitor at least one operating parameter of the magnetic memory and calibrate the sense amplifier if a measured parameter corresponding to the at least one operating parameter is within a range.
2. The magnetic memory of claim 1, wherein the calibration system comprises:
a monitor system configured to provide a first indication if the measured parameter is within the range and provide a second indication if the measured parameter is not within the range; and
an offset calibration system configured to calibrate the sense amplifier when the monitor system provides the first indication.
3. The magnetic memory of claim 2, wherein the monitor system comprises:
a measurement system configured to measure the measured parameter;
a reference comparator configured to compare the measured parameter to a maximum upper value and a maximum lower value which define the range and provide the first indication if the measured parameter is equal to or greater than the maximum lower value and equal to or less than the maximum upper value and provide the second indication if the measured parameter is less than the maximum lower value or greater than the maximum upper value.
4. The magnetic memory of claim 3, wherein the range comprises a minimum upper value which is less than the maximum upper value and a minimum lower value which is greater than the maximum lower value, wherein the minimum upper value is greater than the minimum lower value, and wherein

the reference comparator is configured to provide the first indication if the measured parameter is greater than the minimum upper value and equal to or less than the maximum upper value or less than the minimum lower value and equal to or greater than the maximum lower value.

5. The magnetic memory of claim 4, wherein the measured parameter comprises an oscillation period for a ring oscillator.
6. The magnetic memory of claim 4, wherein the measured parameter comprises a voltage output of a diode circuit.
7. The magnetic memory of claim 2, wherein the offset calibration system comprises:
 - a first voltage reference responsive to first data configured to provide first correction voltages to the sense amplifier; and
 - a second voltage reference responsive to second data configured to provide second correction voltages to the sense amplifier.
8. The magnetic memory of claim 7, wherein the first voltage reference includes:
 - a first up/down counter configured to store first offset data;
 - a first first voltage divider circuit configured to provide a first first back gate bias voltage which corresponds to the first offset data; and
 - a first second voltage divider circuit configured to provide a first second back gate bias voltage which corresponds to the first offset data, wherein the first correction voltages include the first first back gate bias voltage and the first second back gate bias voltage.
9. The magnetic memory of claim 8, wherein the second voltage reference includes:
 - a second up/down counter configured to store second offset data;

a second first voltage divider circuit configured to provide a second first back gate bias voltage which corresponds to the second offset data; and

a second second voltage divider circuit configured to provide a second second back gate bias voltage which corresponds to the second offset data, wherein the second correction voltages include the second first back gate bias voltage and the second second back gate bias voltage.

10. The magnetic memory of claim 9, wherein the first offset data is equal to the second offset data.

11. The magnetic memory of claim 1, wherein one of the at least one operating parameters is a temperature of the magnetic memory.

12. The magnetic memory of claim 1, wherein one of the at least one operating parameters is a power supply voltage supplied to the magnetic memory.

13. The magnetic memory of claim 2, comprising:
at least two memory cells; and
a control system configured to store the first indication and the second indication in the at least two memory cells.

14. A magnetic memory comprising:
an array of memory cells;
an array of bit lines extending in a first direction which intersect the array of memory cells;
an array of word lines extending in a second direction which intersect the array of memory cells;
sense amplifiers coupled to corresponding bit lines; and
a calibration system coupled to the sense amplifiers configured to monitor at least one operating parameter of the magnetic memory and calibrate

the sense amplifiers if a measured parameter corresponding to the at least one operating parameter is within a range.

15. The magnetic memory of claim 14, wherein the calibration system comprises:

a monitor circuit configured to provide a calibration flag if the measured parameter is within the range and provide an out of range flag if the measured parameter is not within the range; and

offset calibration circuit configured to calibrate the sense amplifiers when the monitor circuit provides the calibration flag.

16. The magnetic memory of claim 15, wherein the monitor circuit comprises:

a sensor configured to measure the measured parameter; and

a reference comparison circuit configured to compare the measured parameter to a maximum upper value and a maximum lower value which define the range and provide the calibration flag if the measured parameter is equal to or greater than the maximum lower value and equal to or less than the maximum upper value and provide the out of range flag if the measured parameter is less than the maximum lower value or greater than the maximum upper value.

17. The magnetic memory of claim 16, wherein the range further comprises a minimum upper value which is less than the maximum upper value and a minimum lower value which is greater than the maximum lower value, wherein the minimum upper value is greater than the minimum lower value, and wherein the reference comparison circuit is configured to provide the calibration flag if the measured parameter is greater than the minimum upper value and equal to or less than the maximum upper value or less than the minimum lower value and equal to or greater than the maximum lower value.

17. The magnetic memory of claim 14, wherein the offset calibration circuit comprises:

- a first voltage reference circuit responsive to first offset data configured to adjust the first correction voltages, wherein an amount of the adjustment of the first correction voltages is determined by the first offset data; and

- a second voltage reference circuit responsive to second offset data configured to adjust the second correction voltages, wherein an amount of the adjustment of the second correction voltages is determined by the second offset data.

18. The magnetic memory of claim 17, wherein the first voltage reference circuit includes:

- a first up/down counter circuit configured to store the first offset data;

- a first first voltage divider circuit configured to provide a first first back gate bias voltage which corresponds to the first offset data; and

- a first second voltage divider circuit configured to provide a first second back gate bias voltage which corresponds to the first offset data, wherein the first correction voltages include the first first back gate bias voltage and the first second back gate bias voltage.

19. The magnetic memory of claim 18, wherein the second voltage reference circuit includes:

- a second up/down counter circuit configured to store the second offset data;

- a second first voltage divider circuit configured to provide a second first back gate bias voltage which corresponds to the second offset data; and

- a second second voltage divider circuit configured to provide a second second back gate bias voltage which corresponds to the second offset data, wherein the second correction voltages include the second first back gate bias voltage and the second second back gate bias voltage.

20. The magnetic memory of claim 14, wherein one of the at least one operating parameters is a temperature of the magnetic memory.
21. The magnetic memory of claim 14, wherein one of the at least one operating parameters is a power supply voltage supplied to the magnetic memory.
22. The magnetic memory of claim 15, comprising:
a control system configured to store the calibration flag and the out of range flag in the array of memory cells.
23. A calibration system for a magnetic memory, wherein the magnetic memory includes an array of memory cells and sense amplifiers coupled to the memory cells, comprising:
a monitor system configured to monitor at least one operating parameter of the magnetic memory and provide a first indication if a measured parameter corresponding to the at least one operating parameter is within a range and provide a second indication if the measured parameter is not within the range;
and
an offset calibration system configured to calibrate the sense amplifiers when the monitor system provides the first indication.
24. The calibration system of claim 23, wherein the monitor system comprises:
a measurement system configured to measure the measured parameter;
a reference comparator configured to compare the measured parameter to a maximum upper value and a maximum lower value which define the range and provide the first indication if the measured parameter is equal to or greater than the maximum lower value and equal to or less than the maximum upper value and provide the second indication if the measured parameter is less than the maximum lower value or greater than the maximum upper value.

25. The calibration system of claim 24, wherein the range comprises a minimum upper value which is less than the maximum upper value and a minimum lower value which is greater than the maximum lower value, wherein the minimum upper value is greater than the minimum lower value, and wherein the reference comparator is configured to provide the first indication if the measured parameter is greater than the minimum upper value and equal to or less than the maximum upper value or less than the minimum lower value and equal to or greater than the maximum lower value.

26. The calibration system of claim 25, comprising:
wherein the first voltage reference circuit comprises:
a first up/down counter circuit configured to store the first offset data;
a first first voltage divider circuit configured to provide a first first back gate bias voltage which corresponds to the first offset data; and
a first second voltage divider circuit configured to provide a first second back gate bias voltage which corresponds to the first offset data, wherein the first correction voltages include the first first back gate bias voltage and the first second back gate bias voltage; and
wherein the second voltage reference circuit comprises:
a second up/down counter circuit configured to store the second offset data;
a second first voltage divider circuit configured to provide a second first back gate bias voltage which corresponds to the second offset data; and
a second second voltage divider circuit configured to provide a second second back gate bias voltage which corresponds to the second offset data,
wherein the second correction voltages include the second first back gate bias voltage and the second second back gate bias voltage.

27. A magnetic memory comprising:
a sense amplifier; and

means for monitoring at least one operating parameter of the magnetic memory and calibrate the sense amplifier if a measured parameter corresponding to the at least one operating parameter is within a range.

28. The magnetic memory of claim 27, wherein the means for monitoring comprises:

means for measuring the measured parameter and provide a first indication if the measured parameter is within the range and provide a second indication if the measured parameter is not within the range; and

an offset calibration system configured to calibrate the sense amplifier when the monitor system provides the first indication.

29. A method of monitoring at least one operating parameter of a magnetic memory and calibrating a sense amplifier if a measured parameter corresponding to the at least one operating parameter is within a range, comprising:

measuring the measured parameter; and

comparing the measured parameter to a maximum upper value and a maximum lower value which define the range; and

calibrating the sense amplifier if the measured parameter is equal to or greater than the maximum lower value and equal to or less than the maximum upper value.

30. The method of claim 29, comprising:

providing a data invalid flag if the measured parameter is less than the maximum lower value or greater than the maximum upper value.

31. The method of claim 29, comprising:

calibrating the sense amplifier if the measured parameter is greater than a minimum upper value and equal to or less than the maximum upper value or less than a minimum lower value and equal to or greater than the maximum lower value, wherein the minimum upper value is less than the maximum upper value

and the minimum lower value is greater than the maximum lower value, and wherein the minimum upper value is greater than the minimum lower value, and wherein calibrating the sense amplifier further comprises providing first correction voltages to the sense amplifier; and providing second correction voltages to the sense amplifier.